CNSL ENERGY CONSERVATION OVERVIEW

06 November 2014

Overall Classification

(UNCLASSIFIED)

Introduction

- RIMPAC 2012 Great Green Fleet CSG 11
- Focus of Efforts
- Modernization Initiatives
- Inport Energy Conservation
- Underway Energy Conservation

RIMPAC 2012 Great Green Fleet

USS NIMITZ (CVN 68), USS PRINCETON (CG 59) USS CHUNG HOON (DDG 93), and CVW 11 aircraft received biofuel during the Rim of the Pacific 2012 Great Green Fleet Demonstration. The fuel is a 50/50 blend of advanced biofuel and traditional petroleum-based fuel.

Current Focus Areas

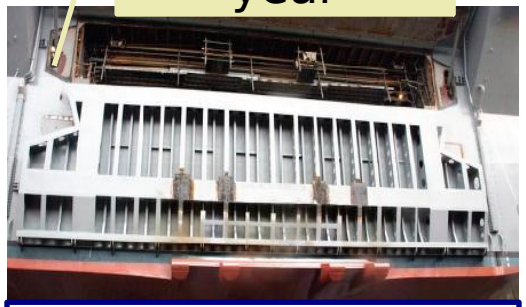
- **Modernization:**
  - **Several initiatives at sea now and in development that improve our energy efficiency**
- **Inport Energy Conservation**
  - **Pier-side monitoring enabling awareness of usage, baseline development, and response to above average usage**
  - **Developing standard inport equipment line ups**
- **Underway Energy Conservation**
  - **Best Practices and Energy Conservation Policy (1 APR 14) set the culture of energy conservation**
  - **CNSL committed to ensuring ships have system operating procedures and references that support efficient operations**
- **Energy Usage Accountability and Recognition**
  - **Ensure strict TYCOM oversight of utility/fuel usage**
  - **Recognize and support ships' conservation efforts**

Modernization

Savings of $380-$450K per year

Stern flaps retrofitted on Flight I and Flight II Hulls. 3000 barrels per year saved.
Flight IIA hulls completed during construction. 2530 barrels per year saved.

DDG Stern Flap



Savings of $810K per year

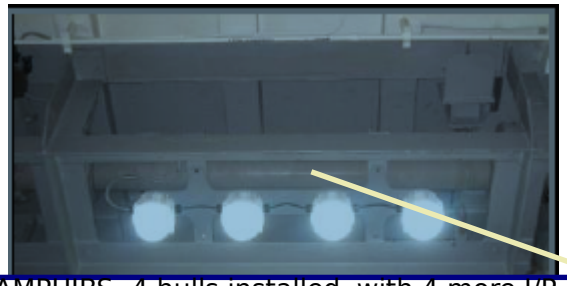
2 Hulls installed with LHD 2 and 7 I/P. 5400 barrels per year saved

LHD Stern Flap

Savings of $63K per year

USS GUNSTON HALL (LSD 44) propellers coated with advanced foul-release in NOV 2003. Prevents accumulation of calcareous deposits. (Designed for L-Class ships with lower SRPMs)
425 barrels per year saved

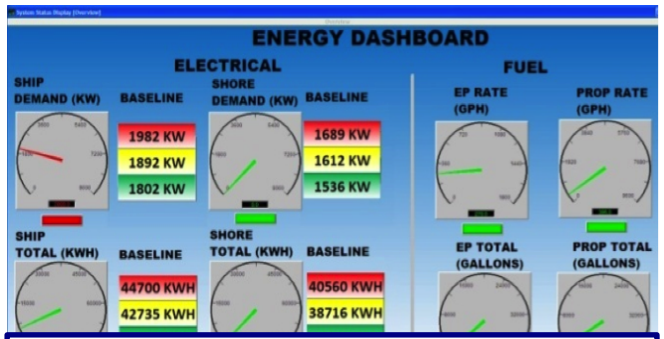
Propeller Coating



AMPHIBS- 4 hulls installed, with 4 more I/P
150 barrels per year saved.
COMBATANTS- 3 hulls installed with 3 more I/P
400 barrels per year saved.

Savings of $22 – 60K per year

Solid State Lighting



6 hulls installed to date. DDG 90,95,100,102,103, and 108 (Slated for all DDG ships)

Energy Dashboard

Modernization

Over $1.2M and 1200 Barrels saved!

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DDG Stern Flap

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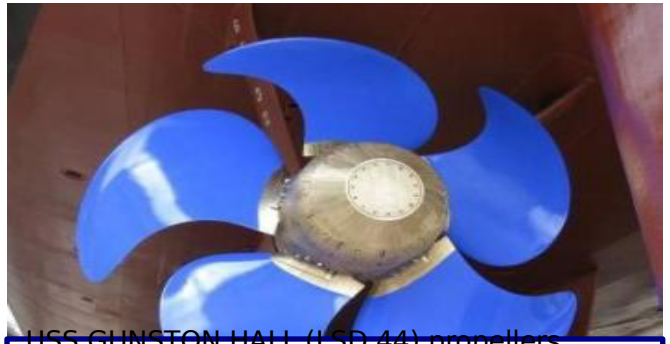

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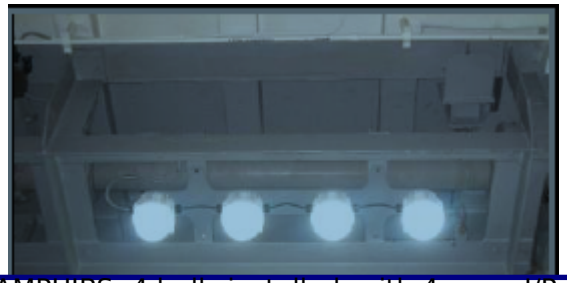

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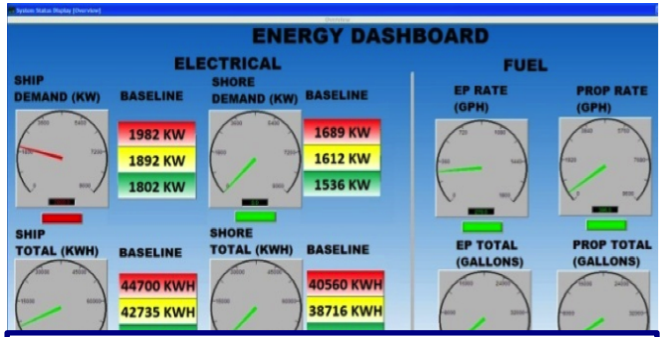

6 hulls installed to date. DDG 90,95,100,102,103, and 108 (slated for ALL DDG ships)

Energy Dashboard

Inport Energy Conservation

- **Ship utility costs shifted from USFF to TYCOMs in FY-11**
  - **Provides tighter oversight and more detailed accountability**
- **Inport Energy Consumption Monthly Billing Report (on line now)**
  - **Documents "actual" electrical usage by ships via the NAVFAC Automated Metering at each pier berth**
- **Developing Ship Class electrical energy consumption baselines**
  - **Baselines to be finalized mid-201**
- **CNSL Inport Energy Manage**
  Engineering Practices' and
  energy usage in port
- **Semi-annual energy training**
  issues
- **Implemented USFF/CPF directed Environmental Protection and Energy Conservation (EPEC) Award in FEB 2012 (In CY 13 added as Battle 'E' criteria)**
  - **Recognizes ships for excellence in environmental protection and energy conservation efforts. (USS COLE (DDG-67) won in CY 2012)**

EPEC award criteria includes:

- Multiple environmental requirements (No spills due to human error, Spill training, etc)
- Fuel consumption at or below assigned allocation
- Completion of I-ENCON training by the CO and CHENG
- Completion of semi annual inport and underway energy conservation training

Inport Energy Conservation

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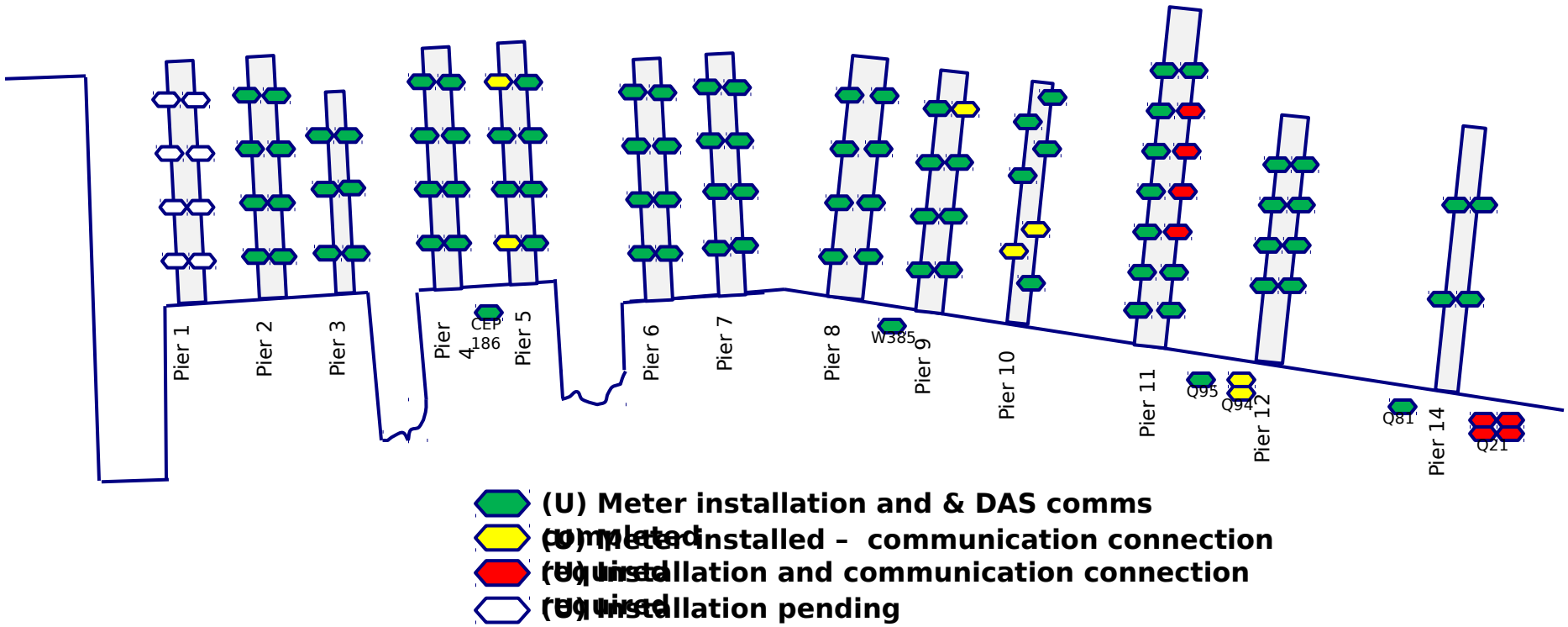
- **Developing Ship Class electrical energy consumption baselines**
  - **Baselines to be finalized mid-2015 (one year after completion of all metering installs)**
- **CNSL Inport Energy Management (IEM) Handbook provides 'Good Engineering Practices' and line-up recommendations to minimize energy usage in port**
- **Semi-annual energy training to advertise and discuss fleet energy issues**
- **Implemented USFF/CPF directed Environmental Protection and Energy Conservation (EPEC) Award in FEB 2012 (In CY 13 added as Battle 'E' criteria)**
  - **Recognizes ships for excellence in environmental protection and energy conservation efforts. (USS COLE (DDG-67) won in CY 2012)**

Automated Metering Infrastructure (AMI)

- Mayport piers completed
- Norfolk Naval Station and Little Creek Piers to be completed by Fall-2014



Example Utility Report - LHD Ships

USS BRAVO Monthly Utility Report (Electric)
Billing Period – 7/6/2013 – 8/9/2013

USS BRAVO was pier side in Norfolk three times between 7/6/2013 – 8/9/2013. BRAVO consumed 2,202,562 kilowatt hours (kWh) of electricity during these port calls with cumulative cost of $225,873 (based on $0.10255/kWh). BRAVO's Average daily consumption was 81,800 kWh ($825 & 8,047kWh below monthly class average). The LHD class comparison is depicted below.

#	Hull #	Ship Name	Usage in Period kWh[2]	Average Daily Use KWh[3]	Days In Port[3]	Average Daily Cost[3]	Cost in Period[2]
1	LHD	ALPHA	774,881	57,658	13	$5,913	$79,464
2	LHD	BRAVO	2,202,562	81,800	26	$8,389	$225,873
		al	2,977,443			Total	$305,337
				66,377	**90%**	**$6,807**	**$159,363**
			Class Average	**73,753**	**100%**	**$7,563**	**$177,070[4]**
			BRAVO	**81,800**	**95%**	**$8,389**	**$225,873**
				81,128	**110%**	**$8,320**	**$194,777**

Green=10% below class average. Our goal!

Red=10% above class average

Monthly Averages for BRAVO

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	58,895	67,041	78,805	71,340	71,144	77,469	81,800					

1) AMI system under construction—provided for energy management awareness only
2) Not Used for Billing – represents ship's contribution to total USFF utility cost
3) Daily averages and days in port computed by using only days where usage is a least 50% of maximum usage during a port call
4) Class averages (avg. usage/day, avg. cost/day and avg.cost/mo.) are weighted by days in port

Underway Energy Conservation

- **Joint TYCOM directive message out by 1 APR 14**
- **Unit CDRs expected to save energy, but must not place ship or mission in jeopardy solely to conserve fuel (ORM)**
- **TYCOMs working to provide supporting energy-saving procedures:**
  - **Some are ready now:**
    - **Trail shaft (25% savings at 12kts)**
    - **Steam ships operate cross-connected (25% savings)**
    - **Operate using “auto pilot”**
    - **Calculate optimum transit speeds using SECAT software (I-ENCON Guide)**
  - **More in development with NAVSEA:**
    - **Drift operations**
    - **LPD 17 class fuel curves**
    - **Diesel ship operation at single engine trail shaft**
- **Incentives:**
  - **CNSP/CNSL Joint Excellence in Environmental Protection and Energy Conservation (EPEC) Award**
  - **SECNAV Incentivized Energy Conservation (I-ENCON) Program Cash Awards ($30K Large ship/ $20K Small ship)(program started in 1990)**

i-ENCON Incentivized Energy Conserv

- Criteria: Total energy saved, cold iron energy saved, awareness and training, innovation (tiebreaker).
- Multiple Categories : Large (>400 crew), Medium (250-400 crew), and Small (<250 Crew) ship, Large and Small ashore.
- Award levels: Platinum, Gold and Blue.

Fleet Awards

1. **SECNAV Energy Awards**
   - **Shipboard Energy Conserva Award**
   - **I-ENCON cash awards and website recognition**
2. **EPEC Award (Environmental Protection & Energy Conservation)**

SECNAV Goals:

- **Increased:**
  - ✓ **energy security**
  - ✓ **ship endurance range and readiness (More fuel for training)**
  - ✓ **mission performance**
- **Decreased:**
  - ✓ **fuel replenishment frequency**
  - ✓ **machinery maintenance (wear & tear)**
  - ✓ **electric & water consumption**
  - ✓ **heat stress and reduced air pollution**

4	DDG 52	USS BARRY	LANT	10.44
5	CG 61	USS MONTEREY	LANT	8.80
6	FFG 55	USS ELROD	LANT	7.50
7	DDG 71	USS ROSS	LANT	6.67
8	LSD 50	USS CARTER HALL	LANT	5.31
9	LHD 1	USS WASP	LANT	5.13
10	DDG 61	USS RAMAGE	LANT	3.42
11	DDG 96	USS BAINBRIDGE	LANT	3.32
12	DDG 68	USS THE SULLIVANS	LANT	3.32
13	LSD 44	USS GUNSTON HALL	LANT	3.31
14	DDG 109	USS JASON DUNHAM	LANT	2.51
15	PC 11	USS WHIRLWIND	LANT	2.37
16	CG 66	USS HUE CITY	LANT	2.19
17	LPD 19	USS MESA VERDE	LANT	1.98
18	FFG 40	USS HALYBURTON	LANT	1.70
19	DDG 94	USS NITZE	LANT	1.47
20	LSD 51	USS OAK HILL	LANT	1.41
21	DDG 95	USS JAMES E. WILLIAMS	LANT	1.20
22	LPD 21	USS NEW YORK	LANT	1.06
23	CG 55	USS LEYTE GULF	LANT	1.00
24	FFG 59	USS KAUFFMAN	LANT	0.96
25	LCC 20	USS MOUNT WHITNEY	LANT	0.54

i-ENCON Incentivized Energy Conservation Shipboard

Fleet Awards

1. SECNAV Energy Awards

- **Shipboard Energy Conservation Award**
- **I-ENCON cash awards and website recognition**

2. EPEC Award (Environmental Protection & Energy Conservation)

SECNAV Goals:

- **Increased:**
  - ✓ **energy security**
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  - ✓ **electric & water consumption**
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3rd QTR Top 25 LANT ships

NO.	SHIP NAME	FLEET	ENCON SCORE
1	USS ELROD	LANT	19.3
2	USS BATAAN	LANT	13.41
3	USS VELLA GULF	LANT	10.74
4	USS WHIDBEY ISLAND	LANT	10.71
5	USS NITZE	LANT	10.56
6	USS ARLEIGH BURKE	LANT	9.07
7	USS GUNSTON HALL	LANT	8.6
8	USS DONALD COOK	LANT	7.08
9	USS HALYBURTON	LANT	6.08
10	USS TAYLOR	LANT	5.6
11	USS ANZIO	LANT	4.72
12	USS FORT MCHENRY	LANT	2.92
13	USS SIMPSON	LANT	2.83
14	USS KAUFFMAN	LANT	2.81
15	USS OAK HILL	LANT	2.42
16	USS NORMANDY	LANT	2.37
17	USS IWO JIMA	LANT	2.36
18	USS THUNDERBOLT	LANT	2.16
19	USS MAHAN	LANT	1.93
20	USS LABOON	LANT	1.49
21	USS KEARSARGE	LANT	1.49
22	USS HUE CITY	LANT	1.37
23	USS SIROCCO	LANT	1.36
24	USS CHINOOK	LANT	1.15
25	USS ROSS	LANT	0.94

Way Ahead

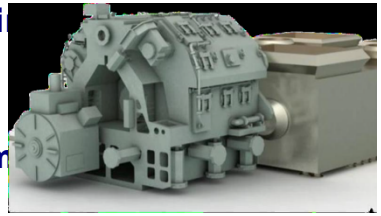
- **Smart Voyage Planning Decision Aid.**
  - **Smart Voyage Planning Decision Aid (SVPDA) is a software applic… by Fleet Weather Centers in Norfolk and San Diego to push optimize… y ships for both maximum fuel efficiency and safety.**
- **Advanced generation Biofuels**
  - **Will serve as "drop in" replacement fuel requiring no mod… nes**
- **Thermal management control for Chill water loops on …**
  - **One install complete. Currently in the evaluation phase.**
- **Bow Bulb optimization for DDGs**
  - **First install planned for 2014. Test ship selection …**
- **Directional stability fins on LHDs**
  - **Currently installed on LHD 2 with testing scheduled for FY14**
- **DDG 51 Class Hybrid Electric Drive.**
  - **Installation on a ship currently on hold fo… nd conti… testing.**
- **Auxiliary Propulsion System.**
  - **Currently installed on LHD 8 /… team**

Optimizes capacity control system and temperature zones throughout ship

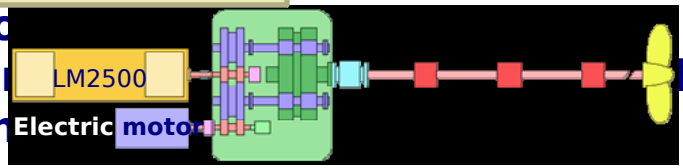
Mounts above existing sonar dome. Improves water flow

Stationary fins mounted behind rudder to minimize wandering

Electric motor retrofitted to MRG



On new Gas turbine powered LHD and LHAs electric motor mounted to MRG (designed with this system)



In addition to these investm…

We MUST make a conscientious effort to be goo… environment through energy conservation effo… his intrinsically, and readily "buy in" to energy con… their ideas to keep our program improving!

Way Ahead

- **Smart Voyage Planning Decision Aid.**
  - **Smart Voyage Planning Decision Aid (SVPDA) is a software application that will be used by Fleet Weather Centers in Norfolk and San Diego to push optimized ship routes to all Navy ships for both maximum fuel efficiency and safety.**
- **Advanced generation Biofuels**
  - **Will serve as "drop in" replacement fuel requiring no modification to existing engines.**
- **Thermal management control for Chill water loops on DDGs.**
  - **One install complete. Currently in the evaluation phase.**
- **Bow Bulb optimization for DDGs**
  - **First install planned for 2014. Test ship selection underway.**
- **Directional stability fins on LHDs**
  - **Currently installed on LHD 2 with testing scheduled for FY14**
- **DDG 51 Class Hybrid Electric Drive.**
  - **Installation on a ship currently on hold for system improvements and continued land based testing.**
- **Auxiliary Propulsion System.**
  - **Currently installed on LHD 8 / LHA 6 class replacing the conventional steam plant.**

In addition to these investments:

We MUST make a habit of saving energy. Our young Sailors get this intrinsically, and readily "buy in" to energy conservation efforts. Leverage their ideas to keep our program improving!


COMMANDER NAVAL SURFACE FORCE
ATLANTIC

Background

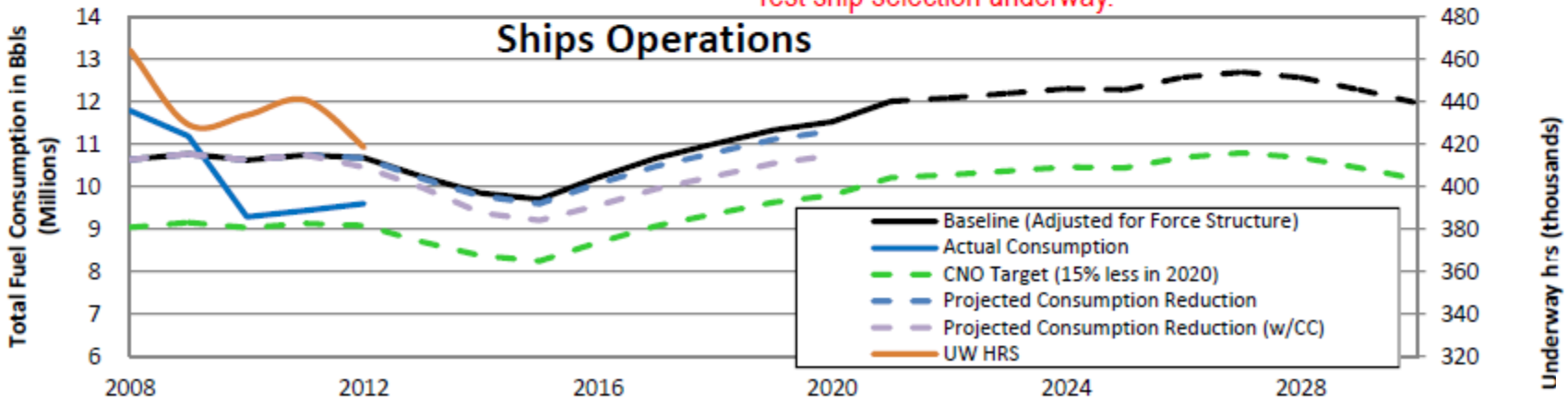
- **NOV 2011: OPNAV directs Fleet and TYCOMs to cut in port energy consumption by 5%**
- **JAN 2013: SECNAV stands up Great Green Fleet Task Force and establishes working groups for Multi-Level Approach to Energy Conservation**
- **CNSL N43 a member of SECNAV Task Force Energy Executive Steering Committee**

- **References:**
  - **CNSL Environmental Protection and Energy Conservation (EPEC) Award (CNSL/CNSP INST 1650.3A dated 2 Nov 2012)**
  - **NAVSEA I-ENCON Guide (Rev4 dated Apr 2013)**

- **Program Management/Oversight**
  - **USFF N46 (Mr. Joe Murphy, SES)**
  - **CNSL N43 (CDR Dave Shaner/Mr. Jim Romeo)**
  - **OPNAV N45E (RDML Kevin Slates)**

Maritime Working Group Technology Status

INITIATIVES	BBLs Saved	1st Install	Installs to Date	STATUS
Energy Conservation Measures (Approved for Fleet Implementation)				
Stern Flaps – LHD	5,450	2006	2	LHD 2,7 in progress. LHD 1 install identified as sequestration cut
Stern Flaps – LSD	1,675	2010	3	LSD 51 install complete in FY 13, 2 installs planned for FY 14.
Combustion Trim Loop - LHD	3,350	2010	5	LHD 1, 2 in progress, LHD 7 planned for 4th quarter, then complete.
Propeller Coatings – LSD	425	2009	1	LSD 51 coating application failed, being treated as uncoated.
Solid State Lighting – AMPHIBS	150	2011	4	4 ship installs to begin in late FY 13.
Solid State Lighting –CRUDES	400	2012	3	3 ship installs complete, 3 ships to begin in late FY 13.
Energy Conservation Concepts (In R&D Phase)				
Shipboard Energy Dashboard–DDG	CC	2011	6	DDG 108 install complete in FY 13, TWH review in progress.
Directional Stability–LHD	4,475	2013	-	Fin Fabrication in progress, install planned for June 2013.
Thermal Management Control–DDG	2,775	2013	1	Evaluation phase. Additional cost incurred due to CW valve issues.
VSD Port Use Fan–LHD	5,125	2013	-	LHD 1 install in progress. Shipboard testing scheduled for FY 14.
VSD CPS–DDG	850	2013	-	DDG 102 install scheduled for Q4 FY 13.
Bow Bulb Optimization—DDG	2,350	2014	-	CNSP requested analysis of performance & test ship schedule risks. Test ship selection underway.



Example Utility Report - CG Ship

USS BRAVO Monthly Utility Report (Electric)
Billing Period – 7/6/2013 – 8/9/2013

USS BRAVO was pier side in Norfolk one time between 7/6/2013 – 8/9/2013. BRAVO consumed 1,142,181 kilowatt hours (kWh) of electricity during these port calls with cumulative cost of $117,131 (based on $0.10255/kWh). BRAVO's Average daily consumption was 32,634 kWh $165 & 1,612 kWh below monthly class average). The CG class comparison is depicted below.

#	Hull #	Ship Name	Usage in Period kWh[2]	Average Daily Use KWh[3]	Days In Port[3]	Average Daily Cost[3]	Cost in Period[2]
1	CG	ALPHA	508,050	31,193	16	$3,199	$52,101
2	CG	BRAVO	1,142,181	32,634	35	$3,347	$117,131
3	CG	CHARLIE	1,172,507	33,500	35	$3,435	$120,241
4	CG	DELTA	847,675	36,172	23	$3,709	$86,929
5	CG	ECHO	728,667	39,684	16	$4,070	$74,725
		Total	4,399,080			Total	$451,126
				30,821	**90%**	**$3,161**	**$88,823**
			Class Average	**34,245**	**100%**	**$3,512**	**$98,693[4]**
			BRAVO	**32,634**	**95%**	**$3,347**	**$117,131**
				37,670	**110%**	**$3,863**	**$108,562**

Monthly Averages for BRAVO

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	41,694	27,864	26,689	23,512	33,554	33,097	32,634					

1) AMI system under construction—provided for energy management awareness only
2) Not Used for Billing – represents ship's contribution to total USFF utility cost
3) Daily averages and days in port computed by using only days where usage is a least 50% of maximum usage during a port call
4) Class averages (avg. usage/day, avg. cost/day and avg.cost/mo.) are weighted by days in port

DDG FLT IIA Data

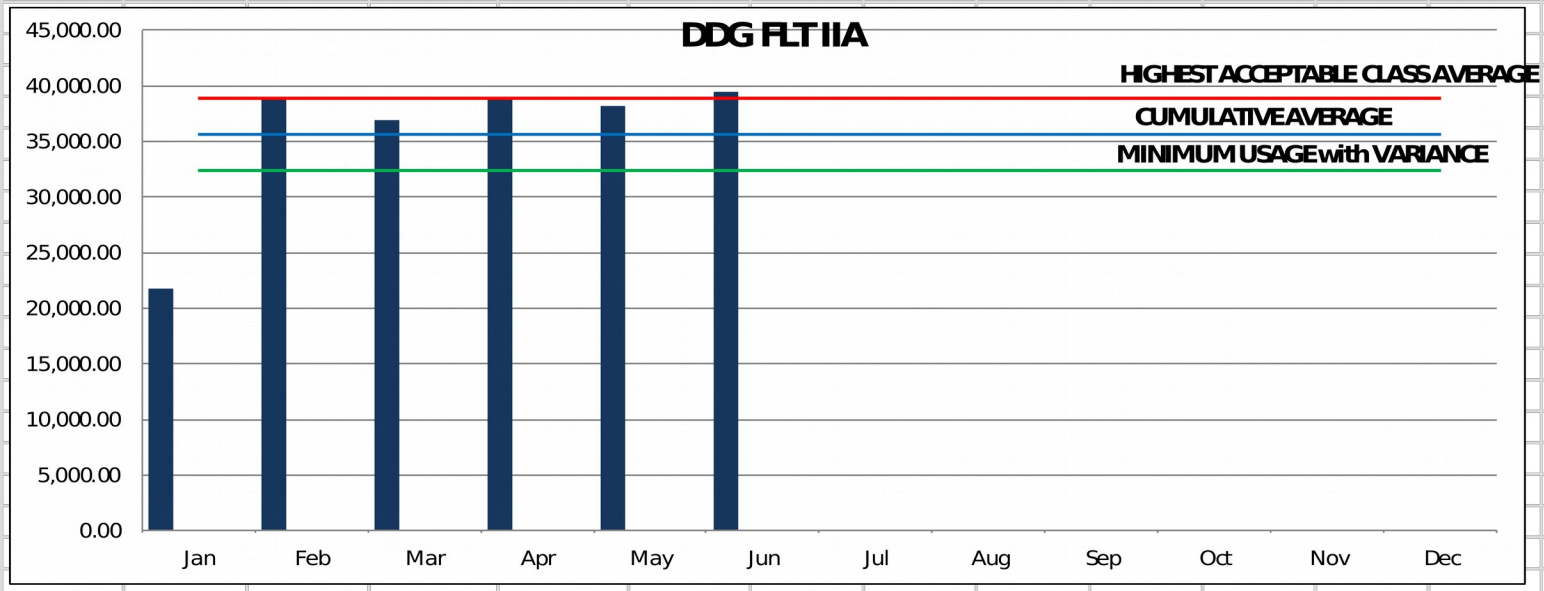
Class-specific Monthly Average, Baseline and Variance

		Cum Avg/ ship =	41,319	kWh
		Variance/ship =	4,126	Highest acceptable Class average
		Cum avg/ class =	35,640	kWh
Number of Vessels in Class =	13	Cum var/ class =	3,196	Highest acceptable Class average
Number of Vessels Considered =	8			
Number of Vessels Eliminated =	0			
Factors considered:				

Flight I and II DDGs: 57, 66, 74, 78

Flight IIA DDGs: 79, 80, 81, 84, 87, 94, 95, 96, 98, 99, 103, 107, 109

BMD DDGs: 51, 52, 55, 58, 61, 64, 67, 68, 71, 72, 75 calculated on DDG BMD Tab



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg/ship	Avg/class	Max	Min
21,771.91	38,771.75	36,942.71	38,835.60	38,137.58	39,380.85	0.00	0.00	0.00	0.00	0.00	0.00	41,319	35,640.07	38,836.07	32,444.06

Underway Fuel Saving Strategies

OP Name	Brief OP Description	Means By Which OP Generates Operational Fuel Savings	All Platforms to Which OP Applies	Technical Coordination Required Before OP Can Become Compulsory	Required OP-Driven Changes to References
Auto-Pilot	Use installed autopilot system during transits.	Adjusts for effects of weather, sea state, currents, and ship-specific hydrodynamic and propulsion data.	DDG 51, FFG 7, CG 47, LSD 41 / 49, LPD 17	None. Ready to implement.	Guidance in VMS
Trail Shaft	One shaft trailing with propeller pitch set IAW EOP to minimize drag.	Much more efficient at slower speeds than two engines idling. On Diesel powered ships, improved the operation and life of the online engine by running in the optimum power range.	DDG 51, CG 47, LSD 41 / 49, LPD 17	None. Ready to implement. Already codified in Engineering Operational Sequencing System Procedures	EOSS (Except FFG 7)
Steam Ships operate cross-connected with one boiler online	Operate a single boiler driving both shafts and all four SSTGs.	At moderate speeds this puts the turbine driven auxiliaries at their most efficient speed. It also uses a greater percentage of the energy produced from the boiler operating at 85%, vice running two boilers at lower (e.g., 40%) loading.	LHD-1	None. Ready to implement. Already codified in Engineering Operational Sequencing System Procedures	EOSS
Minimize Use of Bleed Air System	Utilize bleed air systems only as operationally necessary and to minimize growth / fouling of the masker belts.	Less air loss from engine results in more HP transferred to power turbine, thus more efficient use of fuel burned. Must be balanced against growth in the masker belts.	DDG 51, FFG 7, CG 47.	EOSS procedure exists for aligning / securing. - Need ISEA input on frequency of use to prevent clogging nozzles / belts - Need PMS procedure developed to align system based on ISEA periodicity to prevent clogging.	ECD: 15 Apr
Run Main Propulsion Diesel Engines in Optimum Power Band	Run MPDEs at 80 - 85% load whenever practical. This results in a cleaner burning engine operating at peak efficiency.	Diesel engines operate most efficiently at around 80-85% load. This causes the most complete combustion.	LSD 41/49, LPD 17, PC	Need formal guidance for operation of the engines in trail shaft single engine configuration, and formal guidance (not a CLAD / Advisory) for operation at optimal power settings. -NAVSEA development of LPD-17 fuel curve data in progress.	ECD: 01 Jun
Drift Operations	Secure main propulsion engines when loitering.	Fuel consumption for propulsion is eliminated. Smart use of current and ships position (out of shipping lanes) necessary for success.	DDG 51, FFG 7, CG 47, LSD 41 / 49, LPD 17, PC	- Need NAVSEA to develop drift operations procedures with TYCOM input	ECD: 01 Nov